WHAT IS CLAIMED IS:

1. A method for detecting ultrasonic surface displacements on a target, comprising the steps of:

generating ultrasonic surface displacements at the target;

using a first pulsed laser beam to detect the ultrasonic surface displacements at the target;

collecting phase modulated light from the first pulsed laser beam scattered by the target;

optically amplifying the phase modulated light after the phase modulated light has been collected; and

processing the phase modulated light to obtain data representative of the ultrasonic surface displacements at the target.

2. The method of Claim 1, further comprising preventing reflected phase modulated light feedback into an optical amplifier with at least one optical isolation assembly placed in the path of propagation of the phase modulated light which has been collected.

3. The method of Claim 1, wherein the step of processing the phase modulated light further comprises the steps of:

Using an interferometer to demodulate the phase modulated light for creating at least one optical signal;

converting the at least one optical signal into at least one digital signal; and

using a digital signal processor to process the at least one digital signal.

4. The method of Claim 2, wherein the step of converting the at least one optical signal into at least one digital signal further comprises the steps of:

converting the at least one optical signal into at least one analog signal; and

converting the at least one analog signal into at least one digital signal.

5. The method of Claim 1, wherein the ultrasonic surface displacements at the target are generated using a second pulsed laser beam and wherein the first pulsed laser beam is applied coaxially with the second pulsed laser beam.

6. The method of Claim 1, wherein the step of optically amplifying the phase modulated light is accomplished using a multi-pass optical amplifier.

7. The method of Claim 1, wherein the step of optically amplifying the phase modulated light is accomplished using a doped fiber optic carrier coupled to an optical pump.

8. The method of Claim 1, further comprising amplifying the first pulsed laser beam prior to applying it to the target.

9. A method for generating and detecting ultrasonic surface displacements on a target further comprising the steps of:

using a first pulsed laser beam to generate the ultrasonic surface displacements at the target;

amplifying a second pulsed laser beam;

directing the second pulsed laser beam at the target to detect the ultrasonic surface displacements;

collecting phase modulated light from the second pulsed laser beam which is scattered by the target;

optically amplifying the phase modulated light after the phase modulated light has been collected;

preventing reflected phase modulated light feedback into an optical amplifier with at least one optical isolation assembly placed in the path of propagation of the phase modulated light which has been collected; and

processing the phase modulated light to obtain data representative of the ultrasonic surface displacements at the target.

10. The method of Claim 9, wherein the second pulsed laser beam is applied coaxially with the first pulsed laser beam.

11. The method of Claim 9 wherein the step of optically amplifying the phase modulated light is accomplished using a multi-pass optical amplifier.

12. The method of Claim 9 wherein the step of optically amplifying the phase modulated light is

accomplished using a doped fiber optic carrier coupled to an optical pump.

13. The method of Claim 9 wherein the step of processing the phase modulated light comprises:

using an interferometer to demodulate the phase modulated light to create at least one optical signal;

converting the at least one optical signal into at least one digital signal; and

using a digital signal processor to process the at least one digital signal.

14. The method of Claim 13 wherein the step of converting the at least one optical signal into at least one digital signal comprises:

converting the at least one optical signal into at least one analog signal; and

converting the at least one analog signal into at least one digital signal.

15. The method of Claim 9 further comprising processing the data representative of the ultrasonic surface displacements to determining a location of flaws or an discontinuities at the target.

16. A system for detecting ultrasonic surface displacements occurring on a surface of a target comprising:

a detection laser to generate a first pulsed laser beam to detect the ultrasonic surface displacements at the target;

collection optics for collecting phase modulated light from the first pulsed laser beam scattered by the target;

an optical amplifier to amplify the phase modulated light collected by the collection optics;

at least one optical isolation assembly placed in the path of propagation of the phase modulated light collected by the collection optics for preventing reflected laser light feedback into optical amplifier;

an interferometer to process the phase modulated light and generate at least one output signal; and

a processing unit to process the at least one output signal to obtain data representative of the ultrasonic surface displacements at the target.

17. The system of Claim 16 further comprising an optical amplifier to amplify the first pulsed laser beam generated by the detection laser prior to directing the first pulsed laser beam upon the target.

18. The system of Claim 16 further comprising an optical ranging unit to calculate a distance by which the target is separated from the system.

19. The system of Claim 16 further comprising a generation laser to generate a second pulsed laser beam to induce the ultrasonic surface fluctuations, and wherein the second pulsed laser beam is applied coaxially with the first pulsed laser beam.

20. The system of Claim 16 wherein the optical amplifier is multi-pass optical amplifier.

21. The system of Claim 16 wherein the optical amplifier is comprised of a doped fiber optic carrier and a optical pump coupled thereto.